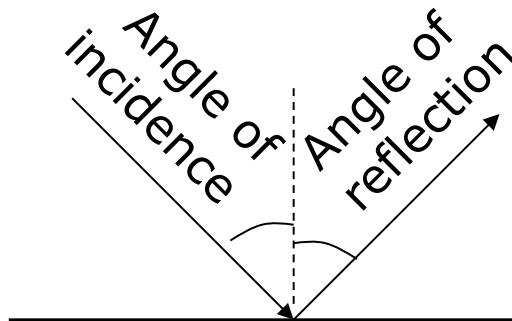


Reflection, Refraction, Diffraction & the Doppler Effect

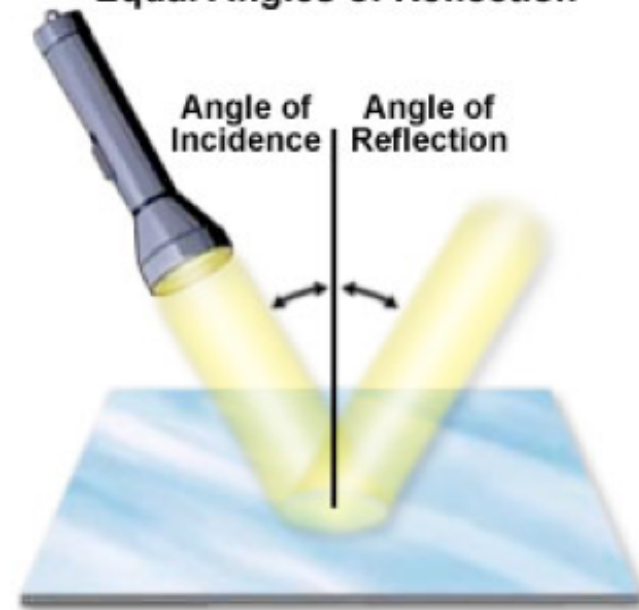


Reflection

- **Reflection** – wave strikes a surface and is bounced back.
 - **Law of Reflection:**
angle of incidence = angle of reflection
 - Assumes smooth surface.
 - Measured from normal.



Equal Angles of Reflection

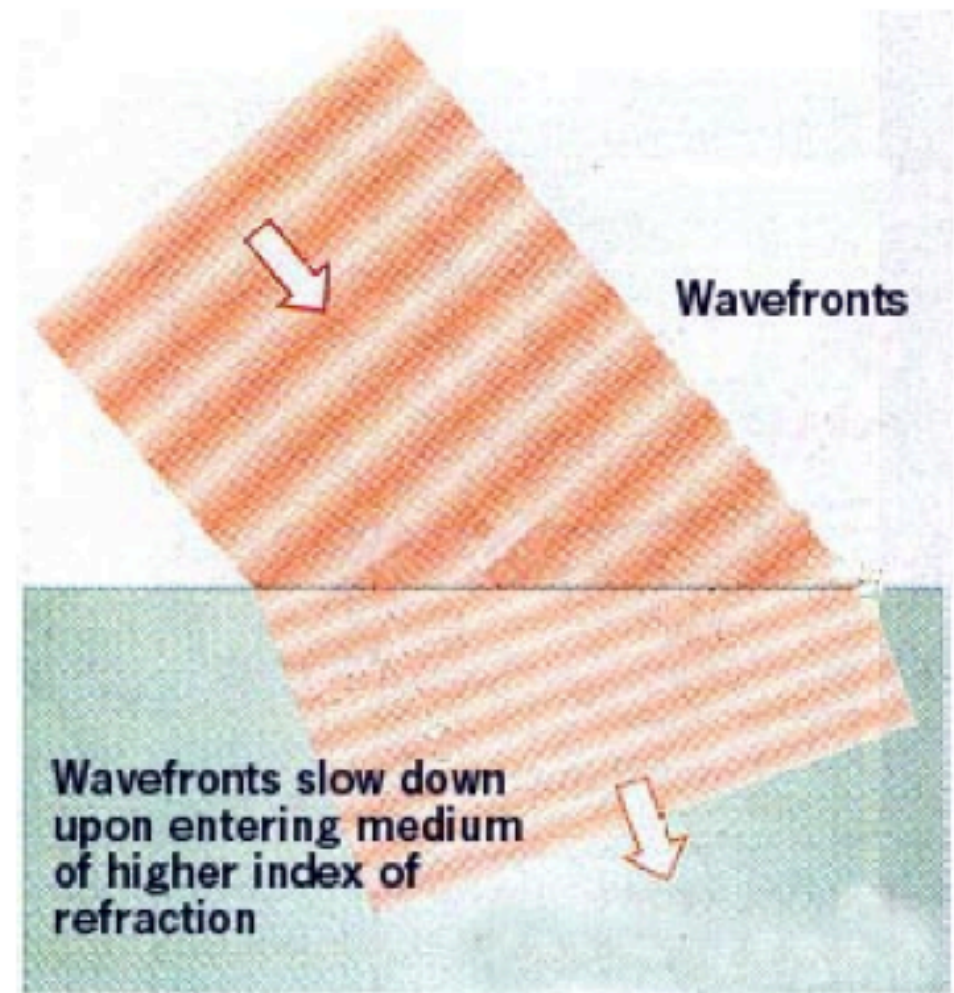


Refraction

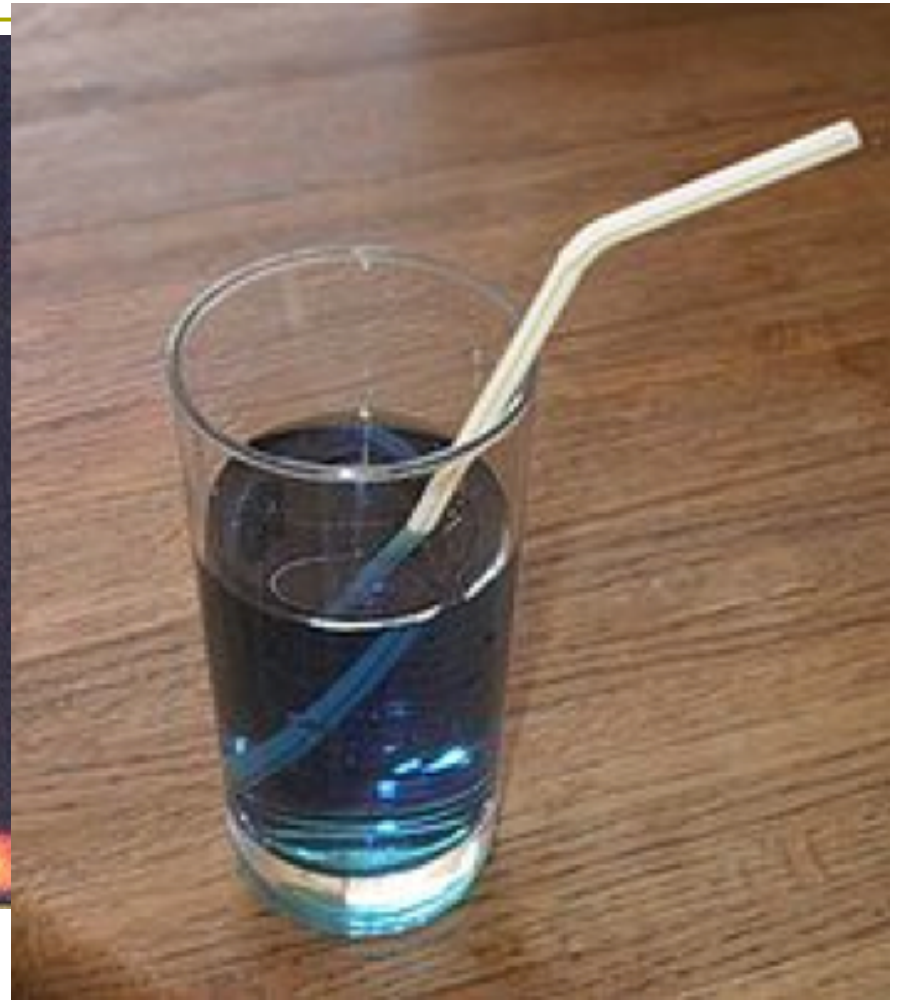
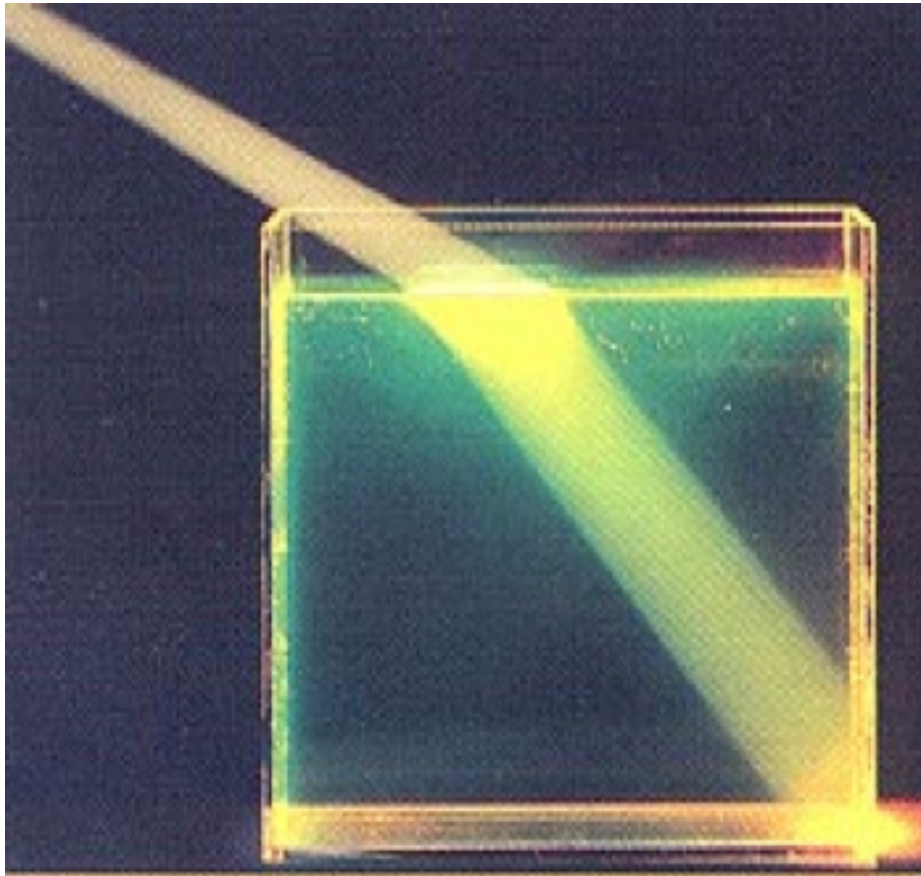
- **Refraction** – change in wave's direction as it passes from one medium to another.
 - Due to differences in speed of wave.
- **Refraction index** (n) – measure of how much a wave's speed is reduced in a particular medium.
 - Most frequently applied to light.
- $n_{\text{medium}} = \frac{\text{speed of light in vacuum} = c_{\text{vacuum}}}{\text{speed of light in medium} = c_{\text{medium}}}$
- Speed of light in vacuum = 300,000,000 m/s.

Waves

- Refraction: a change in direction and speed of a wave due to the medium
 - bends towards normal in more dense object
 - bends away from normal in less dense object



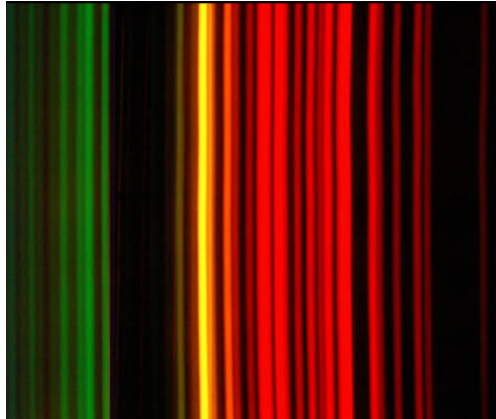
Refraction



Diffraction

- **Diffraction** – The bending of waves around an obstacle.
 - Can let you hear sounds that originate behind an obstacle.
 - Can break visible light up into its wavelength components
- Mr. Quantum on Diffraction
- <http://www.youtube.com/watch?v=DfPeprQ7oGc>
- Explains the diffraction pattern produced in the double-slit experiment caused by interference.

Diffraction grating – with elements



Diffraction grating has allowed Scientists to determine the chemical Make up of stars.

Each element gives off a unique color band pattern (or spectral Pattern)

Scientists noticed that when an object is moving away from the observer, the WAVELENGTH GETS STRETCHED and a RED SHIFT is seen.

When an object is moving closer to an observer, the WAVELENGTH GETS SMALLER and a blue shift is seen.

THE BIG BANG

[The universe is expanding]

Support of the Big bang:



RED shift of galaxies seen

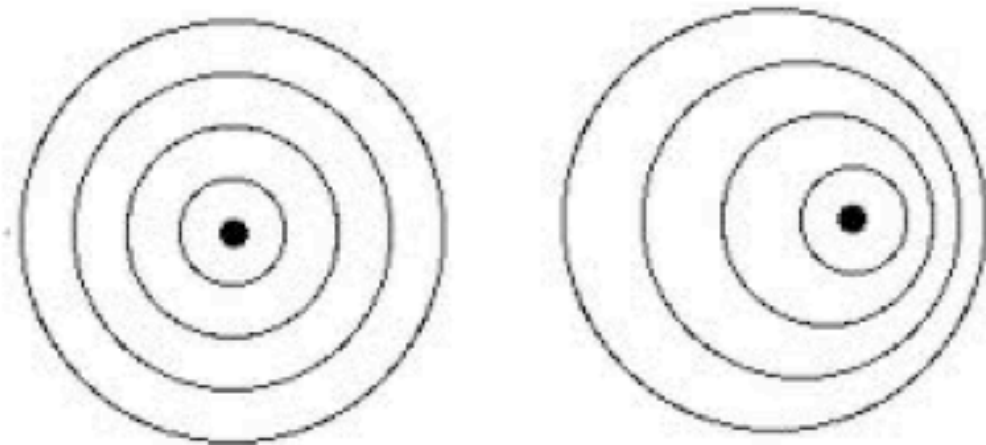
Means galaxies are moving OUTWARD/AWAY

An abundance of Hydrogen

Big bang too hot even for Fusion so
Hydrogen is left over

Waves

- Doppler _____ Effect: produced when a wave source is moving _____ in one direction.
 - When it moves away the wavelength gets ^{longer} _____ (lower frequency _____)
 - When it moves towards the wavelength gets smaller _____ (higher frequency _____)



Waves

The Doppler Effect for a Moving Sound Source

